PLUM BLOTCH, A DISEASE OF THE JAPANESE PLUM, CAUSED BY PHYLLOSTICTA CONGESTA HEALD AND WOLF [1]

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INTRODUCTION

In June, 1905, W. M. Scott of the Bureau of Plant Industry, United States Department of Agriculture, collected near Fort Valley, Ga., fruits of the Japanese plum (*Prunus triflora* Roxbg.) affected with a disease very closely resembling the apple blotch, due to *Phyllosticta solitaria* E. and E. In the diseased areas were spore-bearing pycnidia which were found also on the leaves in gray papery spots resembling those on apple leaves caused by *Phyllosticta solitaria*. On May 27, 1908, the disease was again observed by Scott on both fruit and foliage of the Burbank plum at Montezuma, Ga. It was found to be rather common in several orchards about Montezuma, in some cases causing enough damage to injure seriously the market value of the fruit. In one orchard a large part of the fruit was affected, and many specimens bore from 15 to 20 spots each.

On May 29, 1917, the writer collected near the same locality Japanese plum fruits and leaves affected with the same disease. In the single orchard in which the disease was found, most of the fruit was heavily nfected and rendered nearly worthless. Considerable difficulty was encountered in finding the disease again, as the Japanese plum industry in Georgia had about passed out. Lack of demand for the fruit coupled with the susceptibility of all parts of the tree to various diseases and insect pests had caused growers either to eradicate their trees or to let them die. At present there are almost no Japanese plum orchards remaining in Georgia, and all of the trees in which plum blotch was found have been eradicated. So far as the writer knows, then, the disease no longer exists, though it is to be looked for throughout the South as far west as Texas. Should the growing of Japanese varieties of the plum be revived in the South, blotch may prove to be one of its most serious diseases, as it is very destructive, and probably would be exceedingly difficult to control.

The varieties found to be affected were Abundance, Burbank, and what was apparently an unnamed seedling.

[1] A brief description of this disease was published as an abstract of a paper presented at the Ninth Annual Meeting of the American Phytopathological Society. (ROBERTS, John W. PLUM BLOTCH. (Abstract.) *In* Phytopathology, v. 8, no. 2, p. 74. 1918.)

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DESCRIPTION OF THE DISEASE

The infected parts on the unripe fruit appear as dark-colored raised areas with fringed margins and are somewhat roughened by the presence of small blisters and depressions (Pl. 34, B). As in the case of apple blotch, the skin often becomes ruptured as the fruit increases in size.

On the ripe fruit the blotched parts appear as irregular browned areas 3 to 6 mm. in diameter and consist of an aggregation of from 4 to 20 sunken spots, each separate spot being 1 mm. or less in diameter. At this stage the spots have a peculiar light blue cast owing to the "bloom" of the ripe plum covering the browned epidermis. The diseased area is rather superficial, extending only slightly below the epidermis. The affected tissues become hardened and somewhat leathery and show no tendency to decay.

Small, glistening pycnidia are produced in considerable numbers even in the younger spots. Quite commonly there are 25 to 30 scattered promiscuously about in each blotched area. Infection evidently takes place when the fruits are very young, since the spots found May 29 were well formed and bore pycnidia with mature spores. Judging from the writer's inoculation experiments, infection probably took place five to six weeks earlier, or about the middle of April.

On account of its characteristic appearance on the fruit, the disease has been given the common name of "plum blotch."

On the upper surface of the leaf blades (Pl. 34, A), the spots are angular, rather small (about 0.5 mm. across), brown when young, but later becoming gray or silvery in color. They may be numerous, as many as 200 sometimes appearing on a single leaf. Usually only a single pycnidium is present in each spot, except where two or more spots have coalesced to form a single large spot. Affected areas are also found on the petioles and on the veins of the lower surface, especially on the midrib. On these the diseased areas are much larger than on the upper surface of the blade and are black and sunken. Pycnidia, bearing spores, are present in great abundance.

Pycnidia, apparently identical with those found on the fruit and leaves, were found also in small light-colored, often slightly sunken areas on the twigs; but, as spores were lacking, positive identification could not be made. It is possible that these pycnidia had discharged their spores early in the spring and had brought about the early infections on the fruit.

CAUSE OF PLUM BLOTCH

By comparison with type specimens, the organism involved in the production of plum blotch has been found to be identical with the fungus described by Heald and Wolf [1] as *Phyllosticta congesta.* Heald and

[1] HEALD, F. D., and WOLF, F. A. NEW SPECIES OF TEXAS FUNGI. *In* Mycologia v. 3, no. 1, p. 8. 1911.

Wolf found the fungus on the leaves only of *Prunus* sp. in Texas Their description is as follows:

Maculis minutis, .5–.8 mm diam., brunneis numerosis, venis limitatis; pycnidiis solitariis in quaque area, 50–125 μ diam.; sporulis globulosis vel leniter elongatis, hyalinis 6–9 μ.

On Prunus sp. Boerne (Texas) 1554 (Type).

On the upper surface of the leaf are very numerous brown areolae bounded by the veins of the leaf. The lower surface may not be discolored. These minute spots fuse, and each contains at its center a single black pycnidium. The pycnidia contain globular or slightly oval, clear spores.

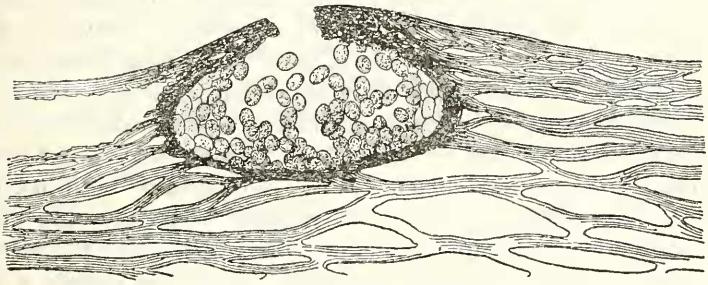

FIG. 1.—Section through a pycnidium of *Phyllosticta congesta*, showing spores. Natural infection on plum fruit, Georgia 1917. × 340.

Heald and Wolf do not mention the fact that the older spots become gray or silvery, though the type specimens as well as those collected by Scott and the writer show this to be the case. The spots on these leaves and those on Georgia specimens collected by the writer show a marked resemblance, and the fungi found upon them are morphologically the same. The spots on the leaves collected by the writer have a greater tendency to fall out.

The pycnidia (fig. 1) are glistening, lens-shaped, erumpent, on the leaves 65 to 120 μ in diameter, on the fruit 60 to 120 μ in diameter. On the average, pycnidia on the fruit are somewhat larger than those on the leaves. Spores on the leaves measured 7 to 9 μ in diameter, on the fruit 8 to 9 μ. Spores from younger spots were invested with gelatinous envelops which were sometimes lengthened into appendages (fig. 2). Spores from older spots do not show these envelops, and they are not to be found in the dried herbarium specimens. The young spores of *Phyllosticta solitaria* have such an envelop. In fact, *P. solitaria* and *P. congesta* resemble one another so closely that on purely morphological grounds they might be considered as identical. Since the ascogenous stage of neither fungus is known, the writer prefers to retain the name *P. congesta* as a matter of convenience, unless it is shown by cross inoculations that the fungus on the apple and that on the plum are identical in every way.

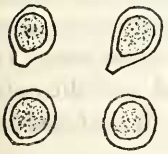

FIG. 2.—Spores of *Phyllosticta congesta*, with the gelatinous envelops which are sometimes present. From pycnidia on plum fruit, Georgia 1917. × 680.

Of course the final test of identity would lie in whether or not the ascogenous stages of the two fungi, assuming them to exist, would prove to be identical.

Specimens of *Phyllostica congesta* on fruit and foliage of *Prunus triflora* have been deposited in the Pathological Herbarium, Bureau of Plant Industry, United States Department of Agriculture.

It is not known how the fungus is carried over from one season to another. If it occurs on the twigs, as the writer is inclined to think, there would be good reason for believing that production of spores from twig lesions in the spring would constitute an important infection source. It is also possible that the fungus survives the winter on leaves and fruit.

On all the ordinary culture media the fungus shows about the same type of growth. On corn meal agar, beef agar, prune agar, potato agar, and oatmeal agar growth is very slow, and on all these media it presents the same appearance. There is a dense black mass of closely woven hyphae forming a raised and irregular aggregation of shining bead-like bodies which may be considered as sterile pycnidia, since they are more or less hollow bodies containing oil drops. The margin of the growth is often fringed; in fact on the above-named media the growth is almost as blotch-like as it is on the fruit of the plum. On sterilized stems of Melilotus the growth resembles that on the agars, but spores are often formed though very scantily.

On Japanese plum twigs growth is also very slow. Pycnidia and spores are formed in about two months. Pycnidia are formed on the bark and may also be formed at the cut end of the twig, in which case they are densely aggregated.

Sterilized apple twigs proved to be the best medium for the production of spores, though two to three months must elapse before spore production begins. On this medium the only sign of growth by the fungus is the formation of a dense mass of hyphae and pycnidia, closely aggregated at the upper end or at an abraided place on the side of the twig. On all the media used the type of growth exhibited by *Phyllosticta congesta* differs somewhat from that of *P. solitaria*. On sterile apple twigs, for instance, the latter produces pycnidia which are scattered over the bark, whereas the pycnidia of the former are formed only at the cut ends of the twigs.

In 1917 the fungus was isolated from both fruit and leaves by the poured plate method, using spores, and by planting bits of the diseased tissues in plates.

In the spring of 1918, no spores had been obtained in cultures, but inoculations were made by spraying the young fruits and leaves of Abundance and Burbank plums with bits of hyphae and sterile pycnidia suspended in sterile distilled water. The results were negative in every case.

In 1919, spores obtained from apple twig cultures and suspended in sterile distilled water were applied to fruit, foliage, and twig of Abundance plums on May 15. Where cultures originally obtained from plum fruits were used, two fruits were found with two typical blotches on each of them; three leaves were found with scattering spots, each spot typical of the disease and each bearing a single pycnidium with the characteristic spores of *Phyllosticta congesta*. Like results were obtained by the use of cultures obtained from the leaves; one fruit showed three typical blotches with pycnidia and two others showed one; seven leaves were successfully infected. From all these artificially inoculated parts, the fungus was reisolated and proved to be *P. congesta*.

No lesions were found on the twigs.

Inoculations made upon Japanese plums with spores from pure cultures of *Phyllosticta solitaria* gave negative results in 1918, 1919, and 1920, though the spores were applied to fruit, foliage, and twigs at frequent intervals throughout the spring.

Though the inoculation experiments herein reported upon are sufficient to prove *Phyllosticta congesta* the cause of plum blotch on leaves and fruit and show the fungus on the fruit to be identical with that on the leaves, they are not as complete as the writer should wish. All the inoculation work was done at Arlington, Va., under conditions probably unfavorable to the fungus, since it has been found naturally only in regions much farther south.

It is planned to carry on further inoculation work with both the plum blotch and apple blotch Phyllostictas. The writer expects eventually to obtain successful inoculations on plum twigs using *Phyllosticta congesta* as inoculum.

CONTROL MEASURES

No attempts to control plum blotch have been made. One would expect that control might be had by spraying with a strong fungicide at intervals beginning shortly after the petals have been shed as is the case with apple blotch. Dilute lime-sulphur solution and Bordeaux mixture injure Japanese varieties of the plum so severely as to preclude their use during the growing season. It is also doubtful whether or not dilute lime-sulphur solution would control severe cases of disease, since it will control only mild cases of apple blotch. Self-boiled lime-sulphur can be used with safety on the Japanese plum, but it is a fungicide which is even weaker than dilute lime-sulphur solution. It seems probable, therefore, that should this disease ever become an important one, its control will present a problem of considerable difficulty, though it is realized that the reasoning by analogy in which the writer has just indulged may easily lead to wrong conclusions.

SUMMARY

Plum blotch, a hitherto unknown disease of the Japanese plum (*Prunus triflora*), has been found in Georgia. In addition to the fruit, the leaves and possibly the twigs are affected. The lesions on fruit and leaves greatly resemble those of the apple caused by *Phyllosticta solitaria* E. and E.

Varieties Abundance and Burbank were found to be susceptible. An unnamed seedling, probably also belonging to *Prunus triflora* was found to be severely infected.

From diseased fruits and leaves the fungus, *Phyllosticta congesta* Heald and Wolf, was isolated and grown in pure culture. Spores obtained from cultures on sterile apple twigs when suspended in distilled water and sprayed on healthy fruits and leaves produced characteristic lesions of the disease.

Phyllosticta congesta Heald and Wolf is to be considered for the present as different from *P. solitaria* E. and E., though greatly resembling it. Inoculation experiments on plums using spores from pure cultures of *P. solitaria* were negative.

No attempts have been made to control plum blotch, but the possibilities of control are discussed.